
Test Procedure for

MINIMUM STANDARDS FOR TESTING AGGREGATE AND CONCRETE MATERIALS



TxDOT Designation: Tex-498-E

Effective Date: January 2021

1. SCOPE

- 1.1 Use this procedure to determine if a laboratory meets the minimum standards for concrete and aggregate testing. The scope of a laboratory's qualification may include only those test procedures relevant to its operations or that may be required under contract. Calibrate or verify all applicable equipment at the specified intervals. In addition to requirements shown below, each apparatus required to perform each test method must be available in the laboratory.
- 1.2 The values given in parentheses (if provided) are not standard and may not be exact mathematical conversions. Use each system of units separately. Combining values from the two systems may result in nonconformance with the standard.
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2. DOCUMENTATION

- 2.1 Maintain documents and all other pertinent information using approved hard copy or electronic forms for all testing equipment calibrated. Documentation must include the following information for each piece of equipment:
- name of equipment;
 - serial number, or other identification number;
 - calibration or verification interval;
 - name of technician performing calibration or verification;
 - dates of calibration, previous calibration, and next calibration;
 - procedure used to calibrate equipment; and
 - results and all pertinent information from the calibration procedure.
- 2.2 Document information from visual inspections using [Form 2651](#), "Visual Inspection Equipment Checklist, 100-E Series Procedures."
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3. CALIBRATION OR VERIFICATION

- 3.1 All equipment that is required to perform each test procedure below must be available in the laboratory and in good working condition.
- 3.2 In addition to the intervals specified below, prior to use, calibrate or verify the calibration of scales, soil compactors, compression machines, and ovens after each time they are moved.
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3.3 Perform the calibration or verification of equipment listed in the tables below.

Table 1—[Tex-401-A](#), “Sieve Analysis of Fine and Coarse Aggregate”

Equipment	Requirements	Procedure	Interval (Months)
Sieves, as listed in procedure	<ul style="list-style-type: none"> Check physical condition Check accuracy 	Tex-907-K	<ul style="list-style-type: none"> 12 12
Quartering machine, sample splitter, or quartering cloth	Visual inspection	---	12
Mechanical Shaker	Verify sieving thoroughness	Procedure 1	12
Balance, Class G2	Verify calibration records	Tex-901-K	12
Oven, $230 \pm 9^{\circ}\text{F}$ ($110 \pm 5^{\circ}\text{C}$)	Verify temperature	Tex-927-K	12
Pans, scoops, brushes, etc.	Visual inspection	---	12

Table 2—[Tex-402-A](#), “Fineness Modulus of Fine Aggregate”

Equipment	Requirements	Procedure	Interval (Months)
Apparatus specified in Tex-401-A	Same as Tex-401-A	Same as Tex-401-A	Same as Tex-401-A

Table 3—[Tex-403-A](#), “Saturated Surface-Dry Specific Gravity and Absorption of Aggregates”

Equipment	Requirements	Procedure	Interval (Months)
Glass jar (pycnometer), 0.5 gal (2 L), and pycnometer cap	Calibrate and check physical condition	Tex-403-A	Each use
Balance, Class G2, Min capacity of 4,000 g	Verify calibration records	Tex-901-K	12
Oven, $230 \pm 9^{\circ}\text{F}$	Verify temperature	Tex-927-K	12
Funnel, wide mouthed	Visual inspection	---	12
Sieves, as listed in procedure	<ul style="list-style-type: none"> Check physical condition Check accuracy 	Tex-907-K	<ul style="list-style-type: none"> 12 12
Pans, 12 in. diameter	Visual inspection	---	12
Small Trowel	Visual inspection	---	12
Syringe or rubber bulb	Visual inspection	---	12
Quartering machine, sample splitter, or quartering cloth	Visual inspection	---	12
Lint free cloth or towel	Visual inspection	---	12
Sample container	Visual inspection	---	12
Suspended Apparatus, as described in procedure	Visual inspection	---	12
Water tank	Visual inspection	---	12
Conical Mold and Tamper	Verify dimensions	Procedure 5	12

Table 4—[Tex-404-A](#), “Determining Unit Mass (Weight) of Aggregates”

Equipment	Requirements	Procedure	Interval (Months)
Scoops, one medium and one small, with square points	Visual inspection	---	12
Quartering cloth or large flat metal pan	Visual inspection	---	12
Balance, Class G20	Verify calibration records	Tex-901-K	12
Metal straightedge	Visual inspection	---	12
Volume measures: volumes of 0.1 and 0.5 cu. ft.	Verify calibration records	Tex-905-K	12
Denim cloth sleeve	Verify measurements	Tex-404-A	12
Tamping rod	Verify measurements	Tex-404-A	12

Table 5—[Tex-405-A](#), “Determining the Percent of Solids and Voids in Concrete Aggregate”

Equipment	Requirements	Procedure	Interval (Months)
Apparatus specified in Tex-403-A	Same as Tex-403-A	Same as Tex-403-A	Same as Tex-403-A
Apparatus specified in Tex-404-A	Same as Tex-404-A	Same as Tex-404-A	Same as Tex-404-A

Table 6—[Tex-406-A](#), “Material Finer than the 75 µm (No. 200) Sieve in Mineral Aggregate (Decantation Test for Concrete Aggregates)”

Equipment	Requirements	Procedure	Interval (Months)
Part I—Laboratory Method			
Balance, Class G2, Min capacity of 6,000 g	Verify calibration records	Tex-901-K	12
Oven, 140 ± 9°F (60 ± 5°C)	Verify temperature	Tex-927-K	12
Oven, 230 ± 9°F (110 ± 5°C)	Verify temperature	Tex-927-K	12
Sieves, as listed in procedure	<ul style="list-style-type: none"> Check physical condition Check accuracy 	Tex-907-K	<ul style="list-style-type: none"> 12 12
Pans	Visual inspection	---	12
Sample splitter or quartering cloth	Visual inspection	---	12
Plaster of paris molds with filter paper	Visual inspection	---	12
Part II—Field Method for Concrete Aggregates			
Apparatus specified in Part I	Same as Part I	Same as Part I	Same as Part I
Wide mouth funnel	Visual inspection	---	12
Glass jar (pycnometer), 0.5 gal. (2 L), and pycnometer cap	Calibrate and check physical condition	Tex-403-A	Each use

Table 6 continued—[Tex-406-A](#), “Material Finer than the 75 µm (No. 200) Sieve in Mineral Aggregate (Decantation Test for Concrete Aggregates)”

Equipment	Requirements	Procedure	Interval (Months)
Part III—Percent of Limestone in Decantation Material			
Desiccator, with indicating type silica-gel desiccant	Visual inspection	---	12
Analytical balance, Class G1, suitable for rapid weighing, Min capacity of 100 g	Verify calibration records	Tex-901-K	12
Beaker, 400 mL	Visual inspection	---	12
Stirrer, magnetic type, with a Teflon-covered bar	Visual inspection	---	12
Burette, class A, 50 ml capacity, graduated to 0.1 mL	Visual inspection	---	12
pH meter, with an accuracy of ± 0.1 pH unit or better, within a temperature range of 32–212°F (0–100°C). The meter must have either a manual or automatic temperature compensator.	Check fluid level in probe and standardize the meter per manufacturer's recommendations.	---	Each use

Table 7—[Tex-407-A](#), “Sampling Freshly Mixed Concrete”

Equipment	Requirements	Procedure	Interval (Months)
As specified in ASTM C172	As specified in ASTM C172	ASTM C172	See ASTM C172

Table 8—[Tex-408-A](#), “Organic Impurities in Fine Aggregate for Concrete”

Equipment	Requirements	Procedure	Interval (Months)
Glass bottles, 12–16 oz., clear glass	Visual inspection	---	12
Sodium hydroxide solution, 3%	Visual inspection	---	12
Glass color standard, mounted in a plastic holder with five organic color numbers, 1–5 (Gardner color standard numbers 5, 8, 11, 14, and 16, ASTM D 1544)	Visual inspection	---	12

Table 9—[Tex-409-A](#), “Free Moisture and Water Absorption in Aggregate for Concrete”

Equipment	Requirements	Procedure	Interval (Months)
Part I—Determining Free Moisture			
Balance, Class G2, Min capacity of 2,000 g	Verify calibration records	Tex-901-K	12
Glass jar (pycnometer), 0.5 gal. (2 L), and pycnometer cap	Calibrate & check physical condition	Tex-403-A	Each use
Towel or lint-free cloth	Visual inspection	---	12
Part II—Water Absorption in Coarse Aggregate			

Balance, Class G2, Min capacity of 4,000 g	Verify calibration records	Tex-901-K	12
Pan, approximately 12 in. in diameter	Visual inspection	---	12
Towel or lint-free cloth	Visual inspection	---	12

Table 10—[Tex-410-A](#), “Abrasion of Coarse Aggregate Using the Los Angeles Machine”

Equipment	Requirements	Procedure	Interval (Months)
Sieves, as listed in procedure	<ul style="list-style-type: none"> Check physical condition Check accuracy 	Tex-907-K	<ul style="list-style-type: none"> 12 12
Balance or scale, Class G2	Verify calibration records	Tex-901-K	12
Oven, 230 ± 9°F (110 ± 5°C)	Verify temperature	Tex-927-K	12
Los Angeles Abrasion Machine and steel spheres	Verify dimensions and RPM	Procedure 6	12

Table 11—[Tex-411-A](#), “Soundness of Aggregate Using Sodium Sulfate or Magnesium Sulfate”

Equipment	Requirements	Procedure	Interval (Months)
Sieves, as listed in procedure	<ul style="list-style-type: none"> Check physical condition Check accuracy 	Tex-907-K	<ul style="list-style-type: none"> 12 12
Oven, 230 ± 9°F (110 ± 5°C), with an evaporation rate of at least 25 g/hr. for 4 hr. while the doors are closed	<ul style="list-style-type: none"> Verify temperature Verify evaporation rate 	<ul style="list-style-type: none"> Tex-927-K Procedure 2 	<ul style="list-style-type: none"> 12 12
Tanks, non-corrosive and non-reactive	Visual inspection	---	12
Perforated containers, of a non-corrosive material, for immersion of samples	Visual inspection	Procedure 7	12
Sulfate solution	Verify temperature and specific gravity of solution	---	Weekly
Solution temperature control device	Visual inspection	---	12
Balance, Class G2	Verify calibration records	Tex-901-K	12
Hydrometer, conforming to the requirements of ASTM E 100	Verify dimensions	ASTM E 100	24
Potable water	---	---	---
Barium chloride (0.2 molar)	Visual inspection	---	12

Table 12—[Tex-412-A](#), “Lightweight Pieces in Aggregate”

Equipment	Requirements	Procedure	Interval (Months)
As specified in ASTM C 123	As specified in ASTM C 123	ASTM C 123	See ASTM C 123

Table 13—[Tex-413-A](#), “Determining Deleterious Material in Mineral Aggregate”

Equipment	Requirements	Procedure	Interval (Months)
Sieves, as listed in procedure	<ul style="list-style-type: none"> Check physical condition Check accuracy 	Tex-907-K	<ul style="list-style-type: none"> 12 12
Oven, $230 \pm 9^{\circ}\text{F}$ ($110 \pm 5^{\circ}\text{C}$)	Verify temperature	Tex-927-K	12
Balance, Class G2, Min capacity of 4,000 g	Verify calibration records	Tex-901-K	12
Pan	Visual inspection	---	12
Small spatula having a blade 4 in. long and 3/4 in. wide	Visual inspection	---	12
Sample splitter, quartering cloth, or quartering machine	Visual inspection	---	12

Table 14—[Tex-414-A](#), “Air Content of Freshly Mixed Concrete by the Volumetric Method”

Equipment	Requirements	Procedure	Interval (Months)
As specified in ASTM C173	As specified in ASTM C173	ASTM C173	See ASTM C173

Table 15—[Tex-415-A](#), “Slump of Hydraulic Cement Concrete”

Equipment	Requirements	Procedure	Interval (Months)
As specified in ASTM C143	As specified in ASTM C143	ASTM C143	See ASTM C143

Table 16—[Tex-416-A](#), “Air Content of Freshly Mixed Concrete by the Pressure Method”

Equipment	Requirements	Procedure	Interval (Months)
As specified in ASTM C231	As specified in ASTM C231	ASTM C231	See ASTM C231

Table 17—[Tex-417-A](#), “Unit Weight, Yield, and Air Content (Gravimetric) of Concrete”

Equipment	Requirements	Procedure	Interval (Months)
As specified in ASTM C138	As specified in ASTM C138	ASTM C138	See ASTM C138

Table 18—[Tex-418-A](#), “Compressive Strength of Cylindrical Concrete Specimens”

Equipment	Requirements	Procedure	Interval (Months)
As specified in ASTM C39	As specified in ASTM C39	ASTM C39	See ASTM C39

Table 19—[Tex-421-A](#), “Splitting Tensile Strength of Cylindrical Concrete Specimens”

Equipment	Requirements	Procedure	Interval (Months)
As specified in ASTM C496	As specified in ASTM C496	ASTM C496	See ASTM C496

Table 20—[Tex-422-A](#), “Measuring Temperature of Freshly Mixed Hydraulic Cement Concrete”

Equipment	Requirements	Procedure	Interval (Months)
As specified in ASTM C1064	As specified in ASTM C1064	ASTM C1064	See ASTM C1064

Table 21—[Tex-423-A](#), “Determining Pavement Thickness by Direct Measurement”

Equipment	Requirements	Procedure	Interval (Months)
Part I—Determining the Thickness of Fresh Hydraulic Cement Concrete Pavement			
Depth rod, round, straight 5/8 ± 1/16-in. diameter rod, 6 in. (150 mm) longer than the depth of pavement, with both ends rounded to a hemispherical tip of the same diameter. The rod should be steel, high-density polyethylene, or other plastic of equal or greater abrasion resistance.	Verify Min dimensions	---	Each use
Standard tape measure readable to 1/16 in. (1 mm) or to the nearest 0.1 in. (2 mm)	Verify required accuracy and minimum range	---	Each use
Part II—Determining the Concrete Thickness and Depth of Reinforcing Steel in Fresh Hydraulic Cement Concrete Bridge Decks and Culvert Top Slabs			
Depth rod, round, straight 5/8 ± 1/16-in. diameter rod, 6 in. (150 mm) longer than the depth of pavement, with both ends rounded to a hemispherical tip of the same diameter. The rod should be steel, high-density polyethylene, or other plastic of equal or greater abrasion resistance.	Verify minimum dimensions	---	Each use
Reinforcing steel depth device, square steel or hard plastic trowel, thin plate, or other similarly rigid device at least 10 in. (254 mm) long and 4 in. (102 mm) high	Verify minimum dimensions	---	Each use
Standard tape measure readable to 1/16 in. (1 mm) or to the nearest 0.1 in. (2 mm)	Verify required accuracy and minimum range	---	Each use

Table 22—[Tex-424-A](#), “Obtaining and Testing Drilled Cores of Concrete”

Equipment	Requirements	Procedure	Interval (Months)
Part I—Obtaining Drilled Concrete Cores			
As specified in ASTM C42	As specified in ASTM C42	ASTM C42	See ASTM C42
Part II—Measuring Length of Drilled Concrete Cores			
As specified in ASTM C174	As specified in ASTM C174	ASTM C174	See ASTM C174
Part III—Compressive or Splitting Tensile Strength of Drilled Concrete Cores			

As specified in ASTM C42	As specified in ASTM C42	ASTM C42	See ASTM C42
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Table 23—[Tex-425-A](#), “Determining Moisture Content in Fine Aggregate by the ‘Speedy’ Moisture Method”

Equipment	Requirements	Procedure	Interval (Months)
Calcium carbide pressure tester set	Visual inspection	---	12
Small scoop	Visual inspection	---	12
Brush and cloth	Visual inspection	---	12
Apparatus, as listed in Tex-103-E	Same as Tex-103-E	Same as Tex-103-E	Same as Tex-103-E
Supply of calcium carbide	Visual inspection	---	12
Standard U.S. No. 4 (4.75 mm) sieve	<ul style="list-style-type: none"> Check physical condition Check accuracy 	Tex-907-K	<ul style="list-style-type: none"> 12 12

Table 24—[Tex-426-A](#), “Estimating Concrete Strength by the Maturity Method”

Equipment	Requirements	Procedure	Interval (Months)
Maturity meter, commercial battery-powered that automatically computes and displays maturity index in terms of a temperature-time factor or both a temperature-time factor and equivalent age	<ul style="list-style-type: none"> Verify proper value of datum temperature is selected Verify calibration 	<p>---</p> <p>Tex-927-K</p>	<p>Each use</p> <p>Each use, Min. every 12 mo.</p>
Thermocouple wire grade ≥ 20 awg.	Visual inspection	---	Each use
Batteries	Verify adequately charged	---	Each use

Table 25—[Tex-429-A](#), “Determining the Percent Solids in Lightweight Coarse Aggregate”

Equipment	Requirements	Procedure	Interval (Months)
Apparatus outlined in Tex-403-A	Same as Tex-403-A	Tex-403-A	See Tex-403-A
Apparatus outlined in Tex-404-A	Same as Tex-404-A	Tex-404-A	See Tex-404-A

Table 26—[Tex-431-A](#), “Pressure Slaking Test of Synthetic Coarse Aggregate”

Equipment	Requirements	Procedure	Interval (Months)
Sieves, as listed in procedure	<ul style="list-style-type: none"> Check physical condition Check accuracy 	Tex-907-K	<ul style="list-style-type: none"> 12 12
Oven, $230 \pm 9^{\circ}\text{F}$ ($110 \pm 5^{\circ}\text{C}$)	Verify temperature	Tex-927-K	12
Balance, Class G2, Min. capacity of 4,000 g	Verify calibration records	Tex-901-K	12
Mechanical Sieve Shaker	Verify sieving thoroughness	Procedure 1-1	12
Pressure cooker, approximately 6 qt. (6 L) capacity with 15 psi (103 kPa) regulator	Visual inspection	---	12
Heavy duty shaker, Equipoise Model No. 5855 or equivalent	Visual inspection	---	12
Heat source	Visual inspection	---	12
Beaker, 250 mL	Visual inspection	---	12
Distilled or de-ionized water	Visual inspection	---	12
Centrifuge bottles, 500 mL Pyrex	Visual inspection	---	12

Table 27—[Tex-432-A](#), “Coarse Aggregate Freeze-Thaw Test”

Equipment	Requirements	Procedure	Interval (Months)
Sieves, as listed in procedure	<ul style="list-style-type: none"> Check physical condition Check accuracy 	Tex-907-K	<ul style="list-style-type: none"> 12 12
Oven, $230 \pm 9^{\circ}\text{F}$ ($110 \pm 5^{\circ}\text{C}$)	Verify temperature	Tex-927-K	12
Balance, Class G2, Min. capacity of 800 g	Verify calibration records	Tex-901-K	12
Freezing chamber, -15°F (9.5°C)	Verify temperature setting	Procedure 3	12
Trays or other containers suitable to hold the samples in a single layer	Visual inspection	---	12

Table 28—[Tex-433-A](#), “Absorption and Dry Bulk Specific Gravity of Lightweight Coarse Aggregate”

Equipment	Requirements	Procedure	Interval (Months)
Balance, Class G2, Min. capacity of 4,000 g	Verify calibration records	Tex-901-K	12
Oven, $230 \pm 9^{\circ}\text{F}$ ($110 \pm 5^{\circ}\text{C}$)	Verify temperature	Tex-927-K	12
Glass jar (pycnometer), 0.5 gal. (2 L), with a pycnometer cap	Calibrate and check physical condition	Tex-403-A	Each use
Standard U.S. No. 5/8 (16 mm) and No. 8 (2.36 mm) sieves	<ul style="list-style-type: none"> Check physical condition Check accuracy 	Tex-907-K	<ul style="list-style-type: none"> 12 12
Funnel, wide mouthed	Visual inspection	---	12
Desiccator	Visual inspection	---	12

Timing device (stopwatch)	Verify accuracy	Tex-924-K	12
Syringe or rubber bulb	Visual inspection	---	12
Distilled or de-ionized water	Visual inspection	---	12

Table 29—[Tex-436-A](#), “Measuring Texture Depth by the Sand Patch Method”

Equipment	Requirements	Procedure	Interval (Months)
As specified in ASTM E965	As specified in ASTM E965	ASTM E965	See ASTM E965

Table 30—[Tex-437-A](#), “Test for Flow of Grout Mixtures (Flow Cone Method)”

Equipment	Requirements	Procedure	Interval (Months)
As specified in ASTM C939	As specified in ASTM C939	ASTM C939	See ASTM C939

Table 31—[Tex-438-A](#), “Accelerated Polish Test for Coarse Aggregate”

Equipment	Requirements	Procedure	Interval (Months)
Wessex Accelerated Polishing Machine	Check rpm, feed rate, water	---	Weekly
British Pendulum Tester (BPT)	Verify calibration records	---	3
Rubber sliders, new, conditioned for the BPT	Visual inspection	---	Each slider
Height measuring dial gauge, accurate to 0.001 in (0.025 mm)	Verify calibration records	---	12
O-rings, rubber, 14 in. (355.6 mm) diameter with a thickness of 0.125 in. (3.2 mm)	Visual inspection	---	12
Oven, 230 ± 9°F (110 ± 5°C)	Verify temperature	Tex-927-K	12
Metal molds, to form test coupons	Visual inspection	---	12

Table 32—[Tex-447-A](#), “Making and Curing Concrete Test Specimens”

Equipment	Requirements	Procedure	Interval (Months)
Part I—Compressive Strength Specimens (Cylinders)			
As specified in ASTM C31 (field specimens), C192 (laboratory specimens), or C1758 (self-consolidating concrete)	As specified in ASTM C31, C192, or C1758	ASTM C31, C192, or C1758	See ASTM C31, C192, or C1758
Other equipment as necessary per Tex-447-A , Part I	As specified in Tex-447-A , Part I	Tex-447-A , Part I	Each use
Part II—Flexural Strength Specimens (Beams)			
As specified in ASTM C31 (field specimens) or C192 (laboratory specimens)	As specified in ASTM C31 or C192	ASTM C31 or C192	See ASTM C31 or C192

Part III—Standard Specification for Moist Cabinets, Moist Rooms, and Water Storage Tanks Used in the Testing of Hydraulic Cement and Concrete			
As specified in ASTM C511	As specified in ASTM C511	ASTM C511	See ASTM C511

Table 33—[Tex-448-A](#), “Flexural Strength of Concrete using Simple Beam Third-Point Loading”

Equipment	Requirements	Procedure	Interval (Months)
As specified in ASTM C78	As specified in ASTM C78	ASTM C78	See ASTM C78

Table 34—[Tex-450-A](#), “Capping Cylindrical Concrete Specimens”

Equipment	Requirements	Procedure	Interval (Months)
Part I—Capping with High Strength Gypsum Plaster			
As specified in ASTM C617	As specified in ASTM C617	ASTM C617	See ASTM C617
Part II—Capping with Sulfur Mortar			
As specified in ASTM C617	As specified in ASTM C617	ASTM C617	See ASTM C617
Part III—Use of Unbonded Caps in Determination of Compressive Strength of Hardened Concrete Cylinders			
As specified in ASTM C1231	As specified in ASTM C1231	ASTM C1231	See ASTM C1231

Table 35—[Tex-460-A](#), “Determining Crushed Face Particle Count”

Equipment	Requirements	Procedure	Interval (Months)
Oven, 230 ± 9°F (110 ± 5°C)	Verify temperature	Tex-927-K	12
Standard U.S. No. 4 (4.75mm) sieve	<ul style="list-style-type: none"> Check physical condition Check accuracy 	Tex-907-K	<ul style="list-style-type: none"> 12 12

Table 36—[Tex-461-A](#), “Degradation of Coarse Aggregate by Micro-Deval Abrasion”

Equipment	Requirements	Procedure	Interval (Months)
Micro-Deval Abrasion Machine and accessories	Verify container and charge dimensions, rotation of machine.	Procedure 4	12
Balance, Class G2, with a Min capacity of 2,000 g	Verify calibration records	Tex-901-K	12
Standard U.S. Sieves	Verify physical condition and accuracy of openings	Tex-907-K	12
Oven, 230 ± 9°F (110 ± 5°C)	Verify temperature.	Tex-927-K	12

Table 37—ASTM C232, “Bleeding of Concrete”

Equipment	Requirements	Procedure	Interval (Months)
As specified in ASTM C232	As specified in ASTM C232	ASTM C232	See ASTM C232

Table 38—ASTM C1610, “Static Segregation of Self-Consolidating Concrete Using Column Technique”

Equipment	Requirements	Procedure	Interval (Months)
As specified in ASTM C1610	As specified in ASTM C1610	ASTM C1610	See ASTM C1610

Table 39—ASTM C1611, “Slump Flow of Self-Consolidating Concrete”

Equipment	Requirements	Procedure	Interval (Months)
As specified in ASTM C1611	As specified in ASTM C1611	ASTM C1611	See ASTM C1611

Table 40—ASTM C1621, “Passing Ability of Self-Consolidating Concrete by J-Ring”

Equipment	Requirements	Procedure	Interval (Months)
As specified in ASTM C1621	As specified in ASTM C1621	ASTM C1621	See ASTM C1621

Table 41—ASTM C1741, “Bleed Stability of Cementitious Post-Tensioning Tendon Grout”

Equipment	Requirements	Procedure	Interval (Months)
As specified in ASTM C1741	As specified in ASTM C1741	ASTM C1741	See ASTM C1741

Table 42—ASTM C1856, “Fabricating and Testing Specimens of Ultra-High Performance Concrete”

Equipment	Requirements	Procedure	Interval (Months)
As specified in ASTM C1856	As specified in ASTM C1856	ASTM C1856	See ASTM C1856

4. PROCEDURES

4.1 Procedure 1—Mechanical Sieve Shaker:

4.1.1 Match the sieve and aggregate such that each sieve retains a minimum of 10% of the total sample weight. After sieving on the mechanical shaker for a given time, check the thoroughness of sieving by hand shaking each sieve with a lateral and vertical motion, accompanied by a jarring action to keep the material moving continuously over the surface of the sieve.

4.1.2 If hand shaking shows more than 1% passing any given sieve, increase shaking time and repeat the check until all screens show less than 1% by weight passing a given sieve.

4.2 Procedure 2—Oven Evaporation Rate Check:

4.2.1 Place 500 g of water at $70 \pm 3^\circ\text{F}$ in each of five 1 L low-form beakers. Position one beaker in each corner and one in the center of one oven shelf. At the end of 4 hr., weigh each beaker and determine the evaporation rate for each location. Repeat for each shelf. The evaporation rate for each location should be at least 25 g/hr. for 4 hr.

- 4.3 *Procedure 3—Temperature-Dependent Apparatus: Freeze-Thaw Chambers, Refrigerators, etc.:*
- 4.3.1 *Apparatus:*
- 4.3.1.1 *Calibrated digital thermometer, graduated in 2°F (1°C), having a range including the temperature range to be checked.*
- 4.3.2 *Procedure:*
- 4.3.2.1 Place the thermocouple probe on the shelf where the samples are normally placed.
- 4.3.2.2 Take the first reading at least 1 hr. after closing the apparatus. (Apparatus should remain undisturbed). Take as many readings as necessary to determine if the temperature range is within the specified tolerance. Three consecutive readings, taken no less than 2 hr. apart and within the tolerance allowed, are required.
- 4.3.2.3 Adjust the temperature of the apparatus if an observed temperature reading is outside the specified tolerance. Allow at least 2 hr. for the temperature to stabilize between each adjustment.
- 4.3.2.4 Repeat taking readings and adjusting the temperature as necessary.
- 4.4 *Procedure 4—Degradation of Coarse Aggregate by Micro-Deval Abrasion:*
- 4.4.1 *Apparatus:*
- 4.4.1.1 *Gauges, calipers, or other measuring devices, with a precision of at least 2.5 µm or 10% of the tolerances listed in AASHTO M 92, Table 1, Column 4.*
- 4.4.1.2 *Calibrated timer, with an accuracy of ± 1 sec. within 120 min.*
- 4.4.1.3 *Balance, Class G2 in accordance with [Tex-901-K](#), with a minimum capacity of 10,000 g.*
- 4.4.1.4 *Steel ruler, readable to 0.1 mm.*
- 4.4.1.5 *Magnetic tool with handle, for separating steel balls from aggregate samples.*
- 4.4.1.6 *Micro-Deval Abrasion Machine, with the following requirements:*
- Note 1**—Safety plaques or decals must be affixed at the operator's station and at any hazardous area, and include necessary warnings and precautions. Permanent plaques are preferred to decals.
- 4.4.1.6.1 *Two-tier jar rolling mill, with a standard operating speed of 100 ± 2 RPM.*
- 4.4.1.6.2 *Electric motor, 110-120V, 60Hz, 1/2 HP minimum.*
- 4.4.1.6.3 *Enclosure, to minimize safety hazard from moving parts and noise. Enclosure material must be clear plexi- or Lexan™ glass with a minimum thickness of 1/4 in. (6.35mm). No moving parts can be exposed during operation, and all bearings must be permanently sealed.*
- 4.4.1.6.4 *Rubber drive rollers, with a Type A-2 Shore Durometer hardness with a reading value of 69 ± -5.*
- 4.4.1.6.5 *Stainless steel jar, with a 1.32 gal. (5 L) capacity with a rubber gasket in the rotary locking cover for each tier, internal diameter of 7.6 ± 0.1 in. (194 ± 2.0 mm), internal height of 6.7 ± 0.1 in. (170 ± 2.0 mm). Inside and outside surfaces of the jar must be smooth and have no observable ridges or indentations. Each jar requires a charge of 5,500 g.*

- 4.4.1.6.6 *Magnetic, martensitic stainless steel balls*, alloy type 440C 58-60 HRC (Hardness), with a diameter of 0.3750 in. (9.250 mm). Balls must be smooth and have no observable ridges or indentations.
- 4.4.1.6.7 *Automatic shutoff timer*, to shut the unit off at the end of the test cycle duration. Timer must be suitable for routine settings of periods of up to a minimum of 120 min. and have an accuracy of ± 1 sec. within 120 min. The timer must stop the jar in less than one rotation at the end of the test cycle.
- 4.4.1.6.8 *Test cycle*: Each tier must be monitored independently and have a digital system that measures and displays the following:
- Revolutions per minute (RPM), with an accuracy of ± 1 revolution over a 120 min. period.
 - Resettable counter that continuously counts the total number of revolutions during the test cycle, with an accuracy of ± 1 revolution for each 15,000 revolutions.
 - Resettable timer to record the duration of the test period, with an accuracy of ± 1 min. over a 120 min. period. The timer must display the number of minutes remaining or the number of minutes elapsed.
- Note 2**—The digital system may be independent or integrated or combination thereof, provided the operator is able to toggle between the readings of at least two measurements during the test cycle duration using a single selector switch.
- 4.4.2 *Materials:*
- 4.4.2.1 *Laboratory reference aggregate*—A supply of standard "Brechtin Quarry No. 2" coarse aggregate available from the Soils and Aggregates Section, Materials Engineering Materials Office, Ministry of Transportation, 1201 Wilson Avenue, Downsview, Ontario, Canada M3M1J8. Fax: 1-416-235-4101
- 4.4.2.2 *Calibration aggregate*—An adequate supply of aggregate, established by the laboratory performing the procedure, meeting the requirements of ASTM D 6928, Section 11.
- 4.4.3 *Procedures:*
- 4.4.3.1 *Micro-Deval Rolling Mill – Revolution Requirement:*
- 4.4.3.1.1 Measure revolutions at 1 min. with a requirement of 100 ± 5 RPM; record the results.
- 4.4.3.1.2 Measure revolutions at 105 min. with a requirement of $10,500 \pm 525$ RPM; record the results.
- 4.4.3.2 *Micro-Deval Rolling Mill – Calibration Requirement:*
- 4.4.3.2.1 Read all of ASTM D 6928, Section 11 before continuing.
- 4.4.3.2.2 Produce 10 samples (per machine) of the reference aggregate in accordance with [Tex-461-A](#), Table 2. Save any unused reference aggregate.
- 4.4.3.2.3 Produce 31 samples (per machine) of the calibration aggregate in accordance with [Tex-461-A](#), Table 2. Save 10 samples to use the following year as the reference aggregate and 11 samples to test, one per month, between calibration periods.
- Note 3**—The calibration aggregate will need to meet the requirements of ASTM D 6928, Section 11.2 before reducing the testing to once a month.
- 4.4.3.2.4 Perform testing in accordance with [Tex-461-A](#), using one reference aggregate sample and one calibration aggregate sample together as a set. Repeat for remaining nine sets of samples. Throughout the process, alternate the two aggregate types on the tiers from one testing session to the next. For example, if the

current set places the calibration aggregate on the top tier and reference aggregate on the bottom tier, the calibration aggregate alternates to the bottom tier and the reference aggregate to the top tier for the next set.

- 4.4.3.2.5 Record all revolutions, machine number and tier, initial weight, final dry weight, and percentage loss on a spreadsheet. Separate the results for the calibration aggregate from the reference aggregate and calculate the average loss (percentage) and standard deviation.
- 4.4.3.2.6 Graph the individual percent loss for the calibration aggregate and reference aggregate on the same chart. This correlates the calibration aggregate to the reference aggregate.
- 4.4.3.2.7 Once the reference aggregate has been correlated to the calibration aggregate, the remaining ten calibration aggregate samples can be saved for use as the reference aggregate the following year.
- 4.4.3.3 *Stainless Steel Sphere Dimension Verification:*
 - 4.4.3.3.1 Measure each stainless steel sphere with a dimension verification requirement of 0.3750 ± 0.02 in. (9.5 ± 0.5 mm); record each measured diameter.
- 4.4.3.4 *Stainless Steel Jar Dimension Verification:*
 - 4.4.3.4.1 Measure the internal diameter of the stainless steel jar with a requirement of 7.6 ± 0.1 in. (193 ± 2.5 mm); record the measured dimension.
 - 4.4.3.4.2 Measure the internal height of the stainless steel jar with a requirement of 6.7 ± 0.1 in. (170 ± 2.5 mm); record the measured dimension.
- 4.4.3.5 *Timer Verification:*
 - 4.4.3.5.1 Simultaneously conduct a run time of 120 min. (7,200 sec.) for the Micro-Deval timer and for the standard timer. Record the readings in seconds.
 - 4.4.3.5.2 Compare the results the two runs and note any variation.
- 4.5 *Procedure 5—Conical Mold and Tamper:*
 - 4.5.1 *Apparatus:*
 - 4.5.1.1 *Ruler*, readable to 0.1 mm.
 - 4.5.1.2 *Digital caliper*, readable to 1 mm (0.1 in.)
 - 4.5.1.3 *Balance*, Class G2 in accordance with [Tex-901-K](#), with a capacity of 500 g.
 - 4.5.2 *Procedures:*
 - 4.5.2.1 *Conical Mold:*
 - 4.5.2.1.1 Using a ruler, measure and record the inside top diameter, inside bottom diameter, and height.
 - 4.5.2.1.2 Using a caliper, measure and record the wall thickness.
 - 4.5.2.1.3 Visually inspect the mold for roundness and undamaged surface.
 - 4.5.2.2 *Tamper:*

- 4.5.2.2.1 Weigh the tamper and record the mass.
- 4.5.2.2.2 Inspect the surface of the tamper to ensure that it is circular and flat.
- 4.6 *Procedure 6—Los Angeles (L.A.) Abrasion Machine and Steel Spheres:*
- 4.6.1 *Apparatus:*
- 4.6.1.1 *Ruler or measuring tape, readable to 0.1 mm.*
- 4.6.1.2 *Balance, Class G2 in accordance with [Tex-901-K](#), with a capacity of 1,000 g.*
- 4.6.1.3 *Stop watch or timer.*
- 4.6.2 *Procedures:*
- 4.6.2.1 *L.A. Abrasion Machine Dimensions and Rotation:*
- 4.6.2.1.1 Using a ruler or measuring tape, measure and record the inside diameter of drum, inside length (across drum), wall thickness, and opening dimensions (L x W).
- 4.6.2.1.2 Using a ruler or measuring tape, measure and record the inside length of the drum (perpendicular to the face the diameter measurement was taken).
- 4.6.2.1.3 Using a ruler or measuring tape, measure and record the opening dimensions of the drum (L x W).
- 4.6.2.1.4 Using a ruler or measuring tape, measure and record the wall thickness of the drum.
- 4.6.2.1.5 Empty the L.A. Abrasion Machine, replace lid, and tighten screws to hold lid in place for test run. Record the initial revolutions or reset counter.
- 4.6.2.1.6 Simultaneously start the L.A. Abrasion Machine and timer or stop watch and allow to run for 5 min.
- 4.6.2.1.7 At the end of 5 min., simultaneously stop the L.A. Abrasion machine and timer and record the counter reading for the number of revolutions. Record the elapsed time in minutes and seconds.
- 4.6.2.1.8 Calculate the Average Speed using the following equation:
$$60 \times (\text{Revolutions} \div \text{Time in seconds})$$
- 4.6.2.2 *Steel Sphere Combined and Individual Weights:*
- 4.6.2.2.1 At random, weigh the steel spheres in combination to match the number of spheres for Grade A, B, C, and D. Compare each combination to the weights specified for each grade in ASTM C 131.
- 4.6.2.2.2 Weigh and record the weight of each individual steel sphere.
- 4.7 *Procedure 7—Sulfate Soundness Sample Containers:*
- 4.7.1 Record the number of individual sulfate soundness sample containers.
- 4.7.2 Visually inspect each container for rust, corrosion, oversized openings, cracks, or any other defect that could affect test results ([Tex-411-A](#) / ASTM C 88).

5. ARCHIVED VERSIONS.

5.1 Archived versions are available.